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Method and Device for Guiding and Supporting a Thin Sheet or Metal Strip

The invention relates to a method as well as a device for guiding and supporting a comparatively thin sheet metal or metal strip during transport across a conveying device, such as a rolling table, and/or during, before or after a cutting process when passing through shears.

In the rolling technology, it has been proven particularly difficult in practice to safely guide thin sheet metal or strips across a conveying device, such as a rolling table, or to shears because thin strips have the tendency to drop or lift after leaving a guiding element and, as a result of this, to impact a subsequently arranged device or a guide element or to fly up and to thereby become deformed. In particular, this problem is observed in connection with shears, without cutting action but also during cutting, when the leading edge of the strip passes through.

In accordance with the developmental tendency toward sheet metal or metal strips that are thinner and thinner, in particular, of non-ferrous metals such as copper or aluminum, but also in connection with very thin steel sheet, this phenomenon results in increasingly greater difficulties. Up to now, no practice-oriented and safe solution has been found for overcoming them.

DE 14 27 231 discloses a device for dividing rolling stock, in particular, sheet metal strips to commercial lengths by means of shears with carriages with a clamping member, wherein the carriages are arranged at the inlet side upstream of the shears and movable along the transport path. The clamping carriage arranged at the inlet side continuously measures the advancement of the sheet metal by means of a pulse generator within the pulse graduation. When a preselected partial length of the sheet metal portion has passed through the cutting plane of the shears, the sheet metal advancement is stopped by means of a digital control member. The one or more clamping carriages grip the transported goods from above and comprise, for temporary coupling the transported goods, solenoids or tongues that are hydraulically operated or operated by known means.

Based on the aforementioned prior art, it is an object of the invention to safely guide thin sheet metal or strips during transport across a conveying device, such as a rolling table and/or during, before or after a cutting process when passing through shears and, in particular, to prevent dropping of a strip head as well as an impact caused thereby on a device arranged downstream, in particular, in the area of shears.

As a solution to this object it is proposed with the invention in connection with a method according to the preamble of claim 1 that the sheet metal or strip is loaded at least from its underside with energy-rich jet bundles of a liquid or gaseous medium and is thereby supported and guided by impulse energy.

Because the stabilization of the strip and particularly of the leading edge of the strip or of the strip head is not provided by mechanical means, but by means of impulse energy of a jet bundle of a liquid or gaseous medium, a collision or impact of the strip or the leading edge of the strip or the strip head on a construction component of any possible type of the rolling table or the shears is safely prevented.

One embodiment of the method suggests that the liquid or gaseous medium is guided under pressure through supply channels in the interior of the transport drum or blade carrier drum to jet nozzles at their periphery, respectively, and flows out of them before and/or behind the support areas of the transport drum or blade drum or as closely as possible adjacent to the blades of the blade drum as a closed jet against the sheet metal or strip at a slant or an angle substantially perpendicular relative to the sheet metal or strip. The jet nozzles according to the invention can be arranged over the entire strip width or over the entire drum length.

An important embodiment of the method according to the invention provides that the medium flows out of jet nozzles oriented against the sheet metal or the strip by employing a rotary valve, preferably arranged in an end face of a rotatable transport drum or blade carrier drum, in a limitable angular position of one drum. The jet width or ejection width of the jet nozzles can be adjustable. This makes it possible that the medium is effective only in the area which is beneficial for stabilizing the strip and that, on the other hand, no inefficient media use takes place. At the same time, overflowing of the direct vicinity of the strip or the shears of the conveying device with excess medium is prevented.

A further embodiment of the method provides that for chisel-type shears comprising a lower or upper drum, provided with a cutting chisel, and a counter drum configured as an anvil, the sheet metal or strip to be cut is loaded with at least one medium jet, respectively, out of each of the drums preferably before and/or behind the cutting plane from above and/or from below. This provides a particularly efficient stabilization of the strip or sheet metal passing through, and this in connection with an economically acceptable expenditure of stabilizing medium.

According to another embodiment of the method it is provided that in connection with shearing-off shears, comprising a blade drum each with a blade having oppositely oriented cutting edges, respectively, the sheet metal or strip to be cut is loaded before and/or behind the separating plane with a supporting medium jet or a plurality of such medium jets from above and/or from below.

This achieves the goal that the strip or sheet metal is lifted off the blade drum in order to better guide it to the devices downstream. For example, the jet nozzles in the smooth anvil drum are to prevent riveting and thus adhesion of the cut leading edge of the strip, and, moreover, an adhesion on the chisel or blade.

Finally, the method according to the invention provides further that during advancing of the sheet metal or strip, in particular, during introduction of its head into the shears, the entry of the head into the area of a guide wedge, arranged stationarily upstream of the shears, as well as its advancing speed are determined by a signaling device and the head is loaded from below by at least one row of medium jets exiting from the guide wedge approximately

perpendicularly against the sheet metal or strip and is guided thereby.

In a device according to the invention for guiding or supporting a thin sheet metal or metal strip, comprising transport drums and/or blade carrier drums, the drums have at their periphery in axis-parallel alignment jet nozzles arranged in at least one row which, upon loading with a liquid or gaseous medium, are oriented against the surface of the metal strip. As a further development of the device, the jet nozzles can be connected, starting at supply channels extending in the interior of the drum, to sources provided outside of the drums with connecting members for a medium that can be supplied under pressure.

Further developments of the devices suggest that between the supply channels of a drum and a source for the medium that can be supplied under pressure at least one pump and at least one rotary valve are arranged.

It is furthermore advantageous that the rotary valve is arranged preferably at an end face of a drum.

Finally, the measure can be used advantageously that in the case of a drum provided with a blade or a cutting chisel the jet nozzles of a row are arranged as closely as possible adjacent to the blade and/or the chisel.

In a further development of the invention it is provided that in the case of transport drums of a rolling table the jet nozzles are loaded quickly successively with medium every time a strip head

passes across a transport drum in order to prevent that the strip head disappears in the downward direction through the rolling table. The drums of the rolling table, for example, to the winding step or to the shears, can be provided with jet nozzles arranged radially about the periphery.

Further details, features, and advantages of the invention result from the following explanation of several embodiments illustrated schematically in the drawings. It is shown in:

Fig. 1 in a representation similar to a flow sheet a transport drum with supply channels and jet nozzles arranged therein, with a rotary valve at the end face, pressure pump, and media source;

Fig. 2 in a side view and partially in section, shearing-off shears with an arrangement of the jet nozzles according to the invention;

Fig. 3 in a side view a similar arrangement with chisel-type shears furnished according to the invention with jet nozzles;

Fig. 4 in a side view shears with stationary guide wedges arranged upstream and downstream and with jet nozzles arranged therein.

The purely schematic illustration of Fig. 1 shows supply channels 4 arranged in a transport drum 7 for supplying the jet nozzles 5 and 5' formed therein. Opposite the end face of the transport drum

7 a rotary valve 9 is arranged which is connected with a central bore 20 to a conveying line 23, extending from a pressure pump 22, for a liquid medium. The rotary valve 9 is arranged so as to be non-rotatable while the transport drum 7 rotates relative thereto when functioning as a transport drum 7 or blade drum 8, as is known in the art. Connecting channels 21, 21' beginning at the central bore 20 and having exit openings at the side facing the end face of the transport drum 7 are provided in the rotary valve 9. Medium that is under pressure is released always when the openings of the supply channels 4 coincide with the oppositely oriented openings of the connecting channels 21 in the rotational direction to thus allow flow in a limited angular range. In other angular positions of the transport drum 7, the supply channels 4 of the transport drum 7 cannot be flushed with pressure medium. It is also possible to adjust different ejection widths with the jet nozzles.

Moreover, the pressure pump 22 with its motor 22' can be controlled via a signal and switching device, similar to the device illustrated in Fig. 4, for example, according to the requirements of an incoming metal strip 1. The pressure pump 22 takes in a liquid medium from the medium source 25 through the intake line 24.

Fig. 2 shows as an example a blade carrier drum 8, 8' with a device for guiding and supporting a comparatively thin sheet metal or metal strip 1. The blade carrier drums are provided with blades 6 in a manner known in the art which interact with one another and cut the metal strip 1 in the cutting plane y-y when contacting one another. The latter is transported on the rolling table 10 and during the cutting process is guided and stabilized from below or

from below and from above by bundles of jets 2, 2' exiting from the jet nozzles 5. The jet nozzles 5, 5' are arranged such that they secure at both sides of the cutting plane y-y the strip 1 in the given position and, in particular, prevent a slanting out of the transport direction. Moreover, in regard to the shearing-off shears 13, same elements are identified with same reference numerals.

In Fig. 3 a similar arrangement is shown with the difference that the shears are chisel-type shears 3 with a cutting chisel 11 wherein a counter drum 8' is correlated with the blade drum 8 provided with the chisel. In this connection, it must be prevented that the strip 1 during cutting by the cutting chisel 11 is riveted to the smooth surface or adheres thereto because then the cut leading edge of the strip would be deformed. Accordingly, the blade drum 8 and, in particular, the anvil drum 8' are provided with supply channels 4 in the aforementioned axis-parallel arrangement which have jet nozzles from which jet bundles 2, 2' of a liquid medium exit and reliably prevent the leading edge of the strip that has been cut from being riveted to or adhering on the counter drum 8'.

Fig. 4 shows a further similar arrangement with chisel-type shears 3 in which between the shears and the rolling table 10 guide wedges 15 are arranged. They have jet nozzles 5 for medium-loaded supply channels 4 which are connected to medium supply lines 29 having a pressure pump 27 arranged therein. Above the sheet metal or metal strip 1 a signaling device 19 monitoring the introduction of the strip at the strip head 16 is provided, wherein the signaling device is in communication via a signal line 26 with the motor 28

of the pressure pump. The pressure pump is supplied with the liquid medium in a manner known in the art from the medium source 25 by means of a suction line. The passage of the strip head 16 of the metal strip 1 is detected by the signaling device 19 which then activates via the signal line 26 the switch for the motor 28 and thus starts the pressure pump 27. The latter conveys the pressure medium through the supply line 29 via the supply channels 4 to the jet nozzles 5. The principle holds true for all jet nozzles, also those in the drums. A signaling device must detected the strip head and the cut. The jet nozzles are then loaded only briefly at the strip head and the cut. The signal can also be used by a device which is already present anyway.

Moreover, the chisel drum of the chisel-type shears 3 is in communication via the rotary valve 9 (not shown in Fig. 4) with the supply channel 4' and the jet nozzles 5' such that a bundled medium jet 2' exits with high energy from below against the metal strip 1 in the area of the strip head 16 and prevents that the comparatively thin and bendable strip 1 bends downwardly and impacts against the guide wedge 15' to the right and is thereby deformed.

Only during the further course of the strip transport, after a certain amount of time or a measured advancing of the metal strip 1, the chisel-type shears 3 are activated and a predetermined length of strip is cut off, wherein the supply channels 4'' of the chisel drum and the counter drum previously unused cooperate with the rotary valve 9 take over the guiding of the strip 1 by means of energy-rich media jets.